J. Malac. Soc. Aust. 5(3-4): 175-193

Small land snails from Northern Australia, II: Species of *Westracystis* Iredale, 1939 (Mollusca: Pulmonata, Helicarionidae)

Alan Solem

Field Museum of Natural History,
Roosevelt Road at Lake Shore Drive,
Chicago, Illinois 60605 U.S.A.

SUMMARY

Dissection of two small helicarionid land snail species from the Kimberley and near Katherine, Northern Territory show that the genus *Westracystis* Iredale, 1939 belongs to the subfamily Helicarioninae. One species, *Westracystis lissus* (E. A. Smith, 1894) and its subjective synonym *Westracystis tentus* Iredale, 1939, is widely distributed in the Kimberley, with records from the Harding and Napier Ranges, north and east of Derby, respectively, to Kalumburu and then west to the Lawford and Laidlaw Ranges on the south-east fringes, finally across the border of the Northern Territory to the Sorby Hills and Keep River in the north with a single record along the Victoria Highway, 25 km east of Timber Creek Police Station. The second species, *Westracystis fredaslini*, new species, is known from the vicinity of Katherine south to Elsie Station on the Roper River, Northern Territory. Discussion of anatomical differences, aestivation strategies, annual growth differences, and ecology help to explain the wide distribution of *W. lissus*.

INTRODUCTION

As a byproduct of field surveys in Northern Australia that focussed on the camaenid lands snails (Solem, 1979, 1981a, 1981b, In preparation), sufficient materials have accumulated of many micro-mollusks to prepare preliminary monographs of several genera. A review of the vertiginid genus *Gyliotrachela* Tomlin, 1930 has been published (Solem, 1981c), and this is the second contribution. It covers the small, horn coloured, smooth surfaced, litter and talus dwelling species that are about 4-11 mm in diameter, and have a rounded to almost slightly angled periphery. The umbilicus is at most narrowly open and usually with waxy secretions inside. Several other, generally smaller, helicarionids with radial or spiral ribs on the spire and a much more sharply angulated periphery occur sporadically within the range of *Westracystis*, as do representatives of the minute, nearly globular genus *Wilhelminaia* Preston, 1913. All of these show shell surface sculpture that is absent in *Westracystis*.

Classification of the Australian Helicarionidae is chaotic. Except for the recent studies of

Kershaw (1978, 1981) on *Helicarion*, all anatomical studies pre-date the classic study of H. B. Baker (1941) on the Pacific Island taxa, which set the minimum standard for subsequent investigations. Data on eastern states species are inadequate to permit comparisons with the dissections reported here, and meaningful generic clustering is impossible without new studies. Genera and *nomina nuda* of Iredale (1933, 1937) cannot be allocated without further study that is beyond the scope of this report.

Placement of *Westracystis* in the Helicarioninae of H.B. Baker (1941: 263) as modified by Solem (1966: 23-24) is possible on the basis of the presence of the retractor caecum (ERC) and long, uncoiled epiphallic flagellum (EF). Dissections of the Lord Howe Island *Epiglypta* (Baker, 1941: pl. 47, figs. 1-3) and *Helicarion leucospira* (Pfeiffer, 1857) (Baker, 1941: pl. 47 figs.4-5) show both taxa have the retractor caecum bound into the penial retractor muscle and a large penis sheath developed. *Epiglypta* has serrated lateral outer edges on the radular marginal teeth, as does the Solomon Island *Helicarion (Sitalarion) planospira* (Pfeiffer, 1853) (see Baker, 1941: pl. 46, fig. 18, pl. 47, fig. 3). Kershaw (1979, 1981) has provided excellent anatomical summaries of several Australian *Helicarion*, which clearly differ from *Westracystis* in lacking the retractor caecum and with very distinctive internal penial wall structures. The many differences in proportionate size and position of genital structures derive from visceral hump reduction in *Helicarion*, and do not indicate fundamental differences. Variation in the form and size of the penis sheath in all of these genera is considerable.

Odhner (1917: 77-84) dissected and illustrated a number of Queensland species in a pioneer study. Only partial data is shown for each taxon, but the absence of either the epiphallic flagellum or the retractor caecum, presence of unicuspid marginal radular teeth, serrated edges on bicuspid marginals, or differences in the relative lengths of terminal female organs, combined to distinguish all of these species from *Westracystis* on the genetic level. Until the Queensland and New South Wales species have been studied to the same degree as *Westracystis*, we lack data sufficient to determine their degree of relationship to each other and to *Westracystis*. The briefly described genera *Expocystis*, *Tarocystis*, and *Melocystis* of Iredale (1937:4-6), based mainly on Odhner's evidence, are separable from *Westracystis* using currently accepted helicarionid generic criteria.

Previous publications on *Westracystis* include the original descriptions of *W. lissus* (E.A. Smith, 1894), mention of this species in a nomenclatural nightmare (Iredale, 1933), citation in check lists (Hedley, 1916; Iredale, 1937), valid description of the genus *Westracystis* (Iredale, 1939), description of *W. tentus* from the Napier Range (Iredale, 1939), and listing of locality records in two faunal papers (Wilson and Smith, 1975; Merrifield, Slack-Smith, and Wilson, 1977). The generic name *Westracystis* was mentioned by Iredale (1933: 56) in the sentence "The West Australian shell Smith named *Lamprocystis lissa* has been transferred to *Microcystis* by Hedley, but it is not much like *Nitor*, the East Australian representative, and therefore may be called *Westracystis* until its anatomy is studied." This cannot be considered a valid description. Iredale (1937: 6) included it in a check list without comment, and finally (Iredale, 1939: 44) provided a barely valid description of both the genus and a new species from the Napier Range, *W. tentus*. The latter was differentiated by its "engraved umbilicus," smaller size, and less notable umbilical ridge.

This paper reviews the anatomy, distribution, and variation in *Westracystis lissus* (Smith, 1894) and describes a new species from near Katherine, Northern Territory, *W. fredaslini*.

ACKNOWLEDGEMENTS

Field work sponsored by the National Science Foundation, Grants DEB 74-20113 and DEB 78-21444 to Field Museum of Natural History, Alan Solem, Principal Investigator, and by staff of the Western Australian Museum, Perth accumulated most of the specimens upon which this report is based. Additional material was seen in the Australian Museum, Sydney, and types were examined at the British Museum (Natural History), London.

The Scanning Electron Microscope illustrations were taken by the author using the Cambridge S4-10 Stereoscan provided Field Museum of Natural History (hereafter

FMNH) through the support of NSF Grant BMS 72-02149. The prints were prepared by the Division of Photography, Field Museum of Natural History, and mounted by Dorothy Karall, Associate, Division of Invertebrates, Field Museum of Natural History. Anatomical and shell illustrations were prepared by Elizabeth A. Liebman and mounted by Dorothy Karall.

For aid with specimen listing and data organization, I am indebted to Margaret Baker, Custodian of the Collections, Division of Invertebrates and to Valerie G. Connor-Jackson, Division of Invertebrates.

SHELL GROWTH AND VARIATION PATTERNS

Most helicarionid and zonitid snails do not show determinate shell growth, reaching "adult size" and then forming an easily recognizable indication of growth cessation, but may instead continue gradual accretive growth indefinitely. Thus size distribution within a population will not be normal and ordinary statistical analysis of variation is meaningless. Inspection of larger samples of dead specimens reveals a dichotomy of size and often apertural features. There will be smaller individuals with 3 3/4 to 4 1/4 whorls, often showing a thick ridge on the outer edge of the parietal callus (fig. 14e), and frequently with the upper palatal lip noticeably sinuated. The second form is distinctly larger, with a range of 4 1/2 to 5 1/4 whorls, rarely with any palatal lip sinuation and normally without trace of a parietal callus ridge (fig. 14b). Most of these larger shells show clear evidence of a growth pause, indicated by dotted lines in fig. 14a, which is located at a point on the shell equivalent to the size range of the small morph.

I interpret this variation to indicate that *Westracystis lissus* lives through at least two wet seasons. The small morph is specimens that have aestivated at the end of the wet season in which they were born, while the large morph consists of specimens that grew during a second wet season. An occasional specimen with two or three growth pauses will be found, but I have no evidence of whether they live beyond the third wet season. My main evidence for this comes from the large sample of live individuals taken from a single rock on the Mitchell Plateau in October 1976 (fig. 13). Both morphs were present and alive in part, although about 20% of the specimens had dried out during the 1976 dry season. Normally by then the first rains would have fallen on the Mitchell Plateau, but these were collected while the dry season was lingering on and thus accurately indicate survivorship into the next wet season. Dissection of both morphs failed to reveal any differences that could be attributed to age. Male and female systems were apparently inactive with small ovotestis (G), slender hermaphroditic duct (GD), and relatively narrow prostate (DG) and uterus (UT) (figs 16a-c). It is hypothesized that *Westracystis* is sexually mature in both morphs and survives into the third wet season. Probably it is reproductively active in both the second and third wet seasons. I can offer no evidence as to whether it lives into and reproduces during a fourth wet season.

In looking at the larger examples, frequently minor growth pauses on the shell can be noted in addition to the major pause that is interpreted as the main dry season hiatus. Probably these indicate short periods of dryness during the late part of the wet season or a period of activation by an early rain followed by continuation of the late dry season. Study of such variation in live specimens and correlation with actual local conditions will be needed to substantiate or disprove this idea.

Many collections did not contain both morphs. I do not consider this to be particularly significant in view of the tendency for specimens of this genus to cluster (figs. 12 and 13). Large clusters, such as on the rock surface, do contain a mixture of morphs, but assemblage of a single cohort on a small leaf an in fig. 12 would happen routinely. Many of such assemblages would tend to die out through exposure to heat or fire during the dry season, and collection from litter would follow subsequently. This clustering tendency also helps explain the very wide distribution of *Westracystis lissus*, since small colonies sealed to dry leaves on the litter surface would be prime candidates for accidental dispersal by winds and ideally suited to establish new colonies.

SYSTEMATIC REVIEW

Genus *Westracystis* Iredale, 1939

Westracystis Iredale, 1933, Rec. Australian Mus., 19 (1): 56 — *nomen nudum;* Iredale, 1937, Australian Zool., 9 (1): 6 — citation in check list without commentary; Iredale, 1939, J. Roy. Soc. Western Australia, 25:44 — description of genus.

Type species. — *Lamprocystis lissa* E. A. Smith, 1894 by original designation.

Because growth is not determinate and most samples of any size had a clear mixture of age classes, no statistical summary of measurements has been prepared. Standard measurements were recorded for the largest individuals in each set, and some data manipulation of these figures undertaken. The results were inconclusive in identifying clear trends geographically. For each area from which a number of collections were available, the maximum size of live collected individuals was 0.7 to 3 mm less than the maximum size of dead shells. Since most collections were made during the early to middle of the dry season, the chance of finding maximum size live specimens may have been reduced. More probably, the phenomenon of allochronic variation is involved, with maximum sized individuals appearing sporadically after one or two heavy wet seasons, while collections in more ordinary years would contain average sized individuals. Of the 18 specimens over 8.7 mm in diameter, 16 were from the Napier Range. This may result from the comparatively large limestone masses in the Napier Range, with multiple fissures and seepage areas that stay wet noticably after surface areas have dried out. A longer period for growth is available in the Napier Range, and the large size may reflect that simple fact.

Westracystis lissus (E. A. Smith, 1894) is smaller, with more tightly coiled whorls, generally sinuated upper lip margin, and the columellar lip more strongly reflected over the umbilicus (fig. 14) than in *W. fredaslini* (fig. 15). The former normally is less than 8.5mm in diameter, while the latter is 9.5-11 mm in diameter. Anatomically, *W. lissus* (fig. 16a) has a longer retractor caecum (ERC), longer epiphallic flagellum (EF), and more of the epiphallus (E) protrudes above the top of the penis sheath than in *W. fredaslini* (fig. 17). *W. lissus* (fig. 18) lacks the double wall to the penis (P) and has a much different sheath (PS) attachment than does *W. fredaslini* (fig. 19). There are obvious differences in the sculpture of the walls of the penis chamber between the two species. So far as is known, none of the other helicarionids from the Kimberley have the prominent shell lobes (L, fig. 17a) found in both *Westracystis.*

Westracystis lissus (E. A. Smith, 1894)
Figs. 1-5, 12, 13, 14, 16, 18

Lamprocystis lissa E. A. Smith, 1894, Proc. Malac. Soc. London, 1(3): 86-87, pl. VII, figs. 22-23 — Queen's Islet, Parry Island (Walker), Burner (= Napier Range) Ranges (Cox).

Microcystis lissa (Smith), Hedley, 1916, J. Roy. Soc. Western Australia, 1: 71.

Westracystis lissus (Smith), Iredale, 1933, Rec. Australian Mus., 19 (1): 56; Iredale, 1937, Australian Zool., 9 (1): 6; Iredale, 1939, J. Roy. Soc. Western Australia, 25: 44.

Westracystis tentus Iredale, 1939, J. Roy. Soc. Western Australia, 25: 44, pl. III, fig. 14 — Barrier Range (= Napier Range) (W. W. Froggatt); Wilson and Smith, 1975, Wild. Res. Bull. Western Australia no. 3: 98-99; Merrifield, Slack-Smith, and Wilson, 1977, Wild. Res. Bull. Western Australia no. 6: 110-119.

Diagnosis: A species of *Westracystis* with long epiphallus (E), epiphallic flagellum (EF), and retractor caecum (ERC, fig. 16a), maximum diameter of shell 7 to 9.5 mm in large morph, upper palatal lip sinuated in part (figs. 14b, e), umbilicus internally with a few incised spiral lines, columellar lip reflecting partly over umbilicus, which is often filled with a waxy secretion. *W. fredaslini* from near Katherine, Northern Territory is closely related, but the shorter epiphallic organs (fig. 17b), shell diameter of 9-11 mm, almost always unsinuated palatal lip, and more open umbilicus with reduced internal sculpture enable identification.

Syntypes: British Museum (Natural History) Queen's Islet, Parry Island, Kimberley, North-west Australia. Collected by J. J. Walker. Also Burner (= Napier Range) Range. Collected by W. W. Froggatt, ex J. C. Cox. Latter specimens are part of the type lot of *Westracystis tentus* Iredale, 1939. Syntypes of *W. tentus* Iredale, 1939 are Australian Museum C.64901 from Barrier Range (= Napier Range) collected by W. W. Froggatt. Iredale (1939: 44) restricted the type locality of *lissa* to Queen's Islet.

Description: Shell of medium size when in large morph, diameter normally less than 9.0 mm, whorls 4 3/4 rarely up to 5 1/8. Coiling pattern tight, lip of shell often sinuated above. Shell surface macroscopically smooth except for growth pauses or repaired injuries indicated by incised radial lines or notches, not shining, at high magnification appears burnished. Umbilicus narrow, partly covered by expansion of columellar lip, internally with a few spiral incised grooves, umbilical opening often filled with waxy secretion. Radular teeth (figs. 1-5) with tricuspid central (fig. 4); usually eight laterals with small endocone shifted higher on mesocone and gradually reduced in size, interrow support system well developed; transition to marginals occuring abruptly (figs. 1-3) and involving gross narrowing of tooth width, loss of endocone, greater elevation of cusp shaft and apical curvature, and disappearance of interrow support system (fig. 3): marginals bicuspid, 25-30 in number, cusp shaft with near vertical elevation (fig. 3), only slight anterior flare (fig. 5), ectocone becoming more prominent on outer (fig. 5) than early (fig. 3) teeth, mesoconal tip sharply pointed and curved from shaft angle. Genitalia (figs. 16a-c, 18) with ovotestis of several small lobules (fig. 16c, G), reduced in size in dry season collections. Hermaphroditic duct (GD) tightly kinked and thick until shortly before entering near base of finger-shaped talon (GT, fig. 16b). Albumen gland (GG) short, tapered (figs. 16a, b), carrefour (X) large. Prostate (DG) and uterus (UT) typical, latter with lower half expanded greatly to form egg encapsulation section. Free oviduct (UV) long and slender. Spermatheca (S, fig. 16a) of medium length with enlarged head, basal part of shaft swollen, larger in diameter than free oviduct (UV), vagina (V) very short and narrowed before entering atrium (Y). Basal parts of spermatheca and free oviduct tightly bound to body wall by muscle fibers. Vas deferens (VD) slender, lightly attached by fibers to outside of penis sheath as is epiphallic flagellum (EF), entering parallel to epiphallic flagellum at point opposite apex of penis sheath (fig. 16a). Epiphallic flagellum (EF) about 80% length of penis sheath, slenderer than epiphallus (E), which extends as a long loop above penis sheath. Penial retractor muscle (PR) very slender, arising from diaphragm, inserting on junction of epiphallus and epiphallic retractor caecum (ERC). Latter (fig. 16a) about two-thirds length of epiphallic flagellum, not bound to penial retractor muscle. Interior of penis (fig. 18) with two corrugated ridges (PP) inside main chamber of thick walled penis. No clear demarcation in sculpture between epiphallus (E) and penis (P). Penis sheath (PS) thin walled below, a thick collar wall attaching near top of larger pilaster, extended upwards in a neck around head of epiphallus and penis. Sheath attaching at junction of penis and vagina to form the short atrium (Y).

Material studied: The following records are organized geographically, roughly west to east. For reasons of space, materials collected in different years and by separate groups of collectors are segregated. Locality data has been abbreviated, with fuller listings given in Solem (1979, 1981a, 1981b, In preparation), Wilson and Smith (1975), Merrifield, Slack-Smith and Wilson (1977). Specimens cited are mainly in the Western Australian Museum (WAM) or Field Museum of Natural History (FMNH).

WESTERN AUSTRALIA Napier Range, August 1975 (Sta. NR I — XXIV) and May 1976 (NRII — 1-31): near northwest corner of Napier Range — Sta. NR VII, NR IX, NR II — 6 (55 dead specimens, WAM 785.76-787.76, WAM 800.76, WAM 941.76, WAM 24.81, WAM 41.81), near Red Bull Mill (2 specimens, WAM 28.81); near Stumpy's Well-Sta. NR V, NR VI (40 specimens, WAM 783.76, WAM 784.76); west of Barker River Gorge — Sta. NR II — 2, NR 11 — 4, NR 11 — 5 (21 specimens, WAM 38.81, WAM 40.81, WAM 43.81, WAM 46.81-49.81), Old Napier Downs Cave (5 specimens, WAM 39.81, WAM 44.81, A.M. Douglas and George Kendrick, 10 July 1966), north side Barker River Gorge (6 specimens, WAM 32.81, A. M. Douglas and George Kendrick, 6 July 1966); east side of Barker Gorge — Sta. NR II — 1 (2 specimens, WAM 35.81); near Wombarella Gap — Sta. NR II — 7 (8 specimens, WAM 37.81); near Yammera Gap — Sta. NR II - 19, NR II - 31 (3 specimens, WAM 33.81, WAM

36.81); 4.5 km north-west of Windjana Gorge — Sta. NR II - 24 (2 specimens, WAM 48.81); Billyarra Spring (2 specimens, WAM 22.81); Windjana Gorge — Sta. NR X — XII, NR XIV (113 specimens. WAM 788.76, WAM 789.76, WAM 791.76, WAM 942.72, WAM 942.76, WAM 34.81, also A. M. Douglas and George Kendrick, 8 specimens, WAM 98.69, 2 July 1966); 1-3 km south-east of Windjana Gorge — Sta. NR XV-XVII (44 specimens, WAM 792.76, WAM 793.76, WAM 795.76); 15 km south-east of Windjana Gorge — Sta. NR XVIII (10 specimens, WAM 975.76); McSherry Gap — Sta. NR XIX, NR XXIV (66 specimens, WAM 794.76, WAM 798.76); near the Tunnel — Sta. NR XX-XXII (16 specimens, WAM 796.76, WAM 797.76, WAM 799.76, WAM 1011.76, also A. M. Douglas and G. Kendrick, 5 specimens, WAM 42.81, 2 July 1966).

Napier Range, October 1976 to April 1977, May 1980 (Sta. WA-568-583): south-east Original Napier Downs Homestead — Sta. WA-322 (9 specimens, FMNH 199328); near Chedda Cliffs — Sta. WA-192 (5 live, 17 dead specimens, FMNH 199415, FMNH 199536, FMNH 200365, WAM 536.80); 7.1 km north-west of Barker Gorge — Sta. 324 (1 specimen, FMNH 199083); Barker Gorge — Sta. WA-357 (1 specimen, FMNH 200322); Wombarella Gap — Sta. WA-333 (2 specimens, FMNH 199900); north-west of Yammera Gap — Sta. WA-325, WA-200, WA-360, WA-572 10 specimens, FMNH 199148, FMNH 199382, FMNH 200289, FMNH 200518, FMNH 204685); 10.5 km south-east of Yammera Gap — Sta. WA-359 (1 specimen, FMNH 199118); south side Windjana Gorge — Sta. WA-193, WA-194 (15 specimens, FMNH 199722, FMNH 200027, FMNH 200043, FMNH 200015, FMNH 200309, FMNH 200371); north side of Windjana Gorge — Sta. WA-308, WA-309 (5 specimens, FMNH 199172, FMNH 200098); 11 km east of Windjana Gorge — Sta. WA-280 (1 specimen, FMNH 199229); 5 km west of Tunnel Creek — Sta. WA-275 (2 specimens, FMNH 199221); Tunnel Creek — Sta. WA-272, WA-274, WA-583 (23 specimens, FMNH 199240, FMNH 199448, FMNH 199887, FMNH 204717, WAM 537.80); east of Tunnel Creek — Sta. WA-270, WA-279 (20 specimens, FMNH 199231, FMNH 199260, FMNH 200212, WAM 538.80).

Harding Ranges: 8 miles north-west of Munja Station (20 specimens, Australian Museum, C. Davis, 17 August 1943).

Leopold Ranges: Mt. Hart Homestead — WA-316, WA-317 (29 specimens, FMNH 199323, FMNH 200505, FMNH 200329, FMNH 200513, WAM 544.80).

Oscar Ranges: near Stumpy's — OR I, OR II (41 specimens, WAM 801.76-803.76, S. Slack-Smith and Barry Wilson, 2 September 1975); Two Mile Bore — Sta. WA-267 (1 specimen, FMNH 199461); Mt. Wynne Creek — Sta. WA-264 (38 specimens, FMNH 199498, FMNH 200225, FMNH 200226, WAM 543.80); Brooking Creek north of Oscar Ranges — Sta. WA-711 (19 specimens, FMNH 205312, FMNH 205313, WAM 548.80); Brooking Gorge — Sta WA-257, WA-258 (5 specimens, FMNH 199488, FMNH 199551, WAM 23.81).

Prince Regent River Reserve, August 1974: Enid Falls, Rufous Creek, Roe River — Sta. E5-1 (33 live, 10 dead specimens, WAM 398.75, WAM 404.75, WAM 416.75, WAM 420.75, WAM 78.81, WAM 81.81-83.81), Sta. E5-2(12 live, 1 dead specimens, WAM 397.75, WAM 399.75, WAM 96.81), Sta. E5-4 (1 dead specimen, WAM 419.75), Sta. E5-5 (3 live, 10 dead specimens, WAM 400.75, WAM 46.81), Sta. E5-6 (4 live, 2 dead specimens, WAM 405.75, WAM 410.75), Sta. E5-7 (12 live, 2 dead specimens, WAM 407.75 WAM 79.81, WAM 80.81), Sta. E5-8 (7 live, 2 dead specimens, WAM 402.75, WAM 414.75, WAM 95.81), Sta. E5-10 (1 dead specimen, WAM 412.75); Garimbu Creek, Roe River — Sta. E6 (27 live, 2 dead specimens, WAM 418.75, WAM 88.81); Youwanjela Creek, Prince Regent River — Sta. W6 (2 dead specimens, WAM 415.75), Sta. W6-1 (4 live, 8 dead specimens, WAM 403.75, WAM 411.75, WAM 94.81), Sta W6-2 (1 live, 3 dead specimens, WAM 406.75, WAM 89.81), Sta. W6-5 (1 live specimen, WAM 90.81); Mt. Trafalgar, Saint George Basin — Sta. W4-1 (3 live, ca. 26 dead specimens, WAM 408.75, WAM 409.75, WAM 413.75, WAM 417.75, WAM 421.75, WAM 93.81).

Prince Regent River Reserve, July 1977: West bank of Roe River (15° 15′ S, 125° 33′ E) — Sta. 1 (1 live, 7 dead specimens, WAM 26.81, WAM 27.81); island on north side of mouth, Roe River Estuary (15° 06′ S, 125° 21′ E) (1 dead specimen, WAM 29.81).

Beverley Springs Station: Plain Creek Gorge (2 live, 1 dead specimens, WAM 377.75).

Mitchell Plateau, July 1975: Sta. MP 3 (1 specimen, WAM 51.81), Sta. MP 4 (24 specimens, WAM 50.81, WAM 51.81, WAM 55.81), Sta. MP 5 (2 specimens, WAM 52.81) Sta. MP 14 (32 specimens, WAM 54.81, WAM 97.81), vine thicket at map reference Warrender 4068 — 018:535 (1 specimen; WAM 53.81), Sta. 4, 6 km north of Hair Creek, Gibb River-Kalumburu road (Bradshaw 4167 — 990:125) (37 specimens, WAM 25.81, WAM 77.81).

Mitchell Plateau, October-November 1976: vine thicket at map reference Warrender 4068 — 076:760 (30 specimens, WAM 57.81); Walsh Point (3 specimens, WAM 31.81); south face McGregor Point, Admiralty Gulf (16 specimens, WAM 86.81); Sta. 2, east of Crystal Creek Pools (58 specimens, WAM 84.81, WAM 92.81); Crystal Creek track vine thicket (Warrender 4068 — 004:885) (1 specimen, WAM 87.81); Warrender Road, 6 km north of Surveyor Pool turnoff (33 specimens, WAM 85.81, WAM 91.81).

Mitchell Plateau, October to November 1976: drop-off camp area, Warrender Road — Sta. WA-201, WA-202, WA-203, WA-221 (332 specimens, FMNH 199558, FMNH 200029, FMNH 200090, FMNH 200125, FMNH 200127, FMNH 200374, FMNH 200376-7, FMNH 200380-2, FMNH 200565, WAM 526.80-528.80, WAM 531.80-533.80); Crystal Creek vine thicket — Sta. WA-204 (44 specimens, FMNH 199561, FMNH 199567, FMNH 199393, FMNH 200388, FMNH 200399, FMNH 200401, FMNH 200404, FMNH 200408, FMNH 200421, FMNH 200432, WAM 534.80, WAM 535.80); vine thicket above Camp Creek — Sta. WA-206 (1 specimen, FMNH 200435); Walsh Point — Sta. WA-207 (6 specimens, FMNH 199373, FMNH 199519); 5 km towards Camp Creek quarry from AMAX turnoff — Sta. WA-210 (1 specimen, FMNH 200443); vine thicket at west end of WA-201 valley — Sta. WA-212 (42 specimens, FMNH 199600, FMNH 200074, FMNH 200450, FMNH 200452, FMNH 200458, FMNH 200462, FMNH 200464, FMNH 200467, WAM 529.80 WAM 530.80); vine thicket west of drop-off — Sta. WA-384 (2 specimens, FMNH 200003, FMNH 200008); 0.8 km south of AMAX camp — Sta. WA-391 (2 specimens, FMMH 199284); Walsh Point Road vine thicket — Sta. WA-393 (4 specimens, FMNH 199316, FMNH 199808).

Drysdale River National Park, late August 1975: Sta. 1, Ashton Range (15° 11′ S, 126° 48′ E) (ca. 41 specimens, WAM 125.76, WAM 126.76); Sta. 2, gully of Drysdale River tributary (14° 35′ S, 127° 02′ E) (25 specimens, WAM 127.76-129.76); Sta. B1-5, Glider Gorge (Carson 4268 - 662:600) (10 specimens, WAM 130.76-133.76); Sta. C1-2, Worriga Gorge (Ashton 4267 — 491:376) (10 specimens, WAM 134.76, WAM 136.76); Sta. C1-3, Worriga Gorge (Ashton 4267 — 491:389) (7 specimens, WAM 137.76); Sta. C1-5, Elasmias Creek (Ashton 4267 —493:366) (7 specimens, WAM 138.76); Sta. C1-6, Worriga Gorge (Ashton 4267 — 489: 369) (5 specimens, WAM 139.76); Sta. C1-7, Colochasia Creek (Ashton 4267 — 490:394) (41 specimens, WAM 140.76); Sta. C2-5, Woorakin Creek (Ashton 4267 — 571:346) (2 specimens, WAM 141.76); Sta. C2-6, Woorakin Creek Gorge (Ashton 4267 — 565:345) (1 specimen, WAM 142.76); Sta. C2-7, Woorakin Creek Gorge (Ashton 4267 — 555:341) (3 specimens, WAM 143.76); Sta. C2-12, Woorakin Creek Gorge (Ashton 2467 — 560:342) (2 specimens, WAM 144.76); Sta. C4, Carlia Creek (15° 01′ S, 126° 49′ E) (16 specimens, WAM 145.76); Sta. C5-2, Forest Creek (Carson 4268 — 768:789) (3 specimens, WAM 146.76); Sta. C5-3, Forest Creek (Carson 4268 - 786:788) (ca. 10 specimens, WAM 147.76); Sta. C5-4, Forest Creek (Carson 4268 — 786:785) (ca. 5 specimens, WAM 148.76); Sta. C5-5, Forest Creek (Carson 4268 — 786:785) (ca. 10 specimens, WAM 149.76); Sta. C5-6, Forest Creek (Carson 4268 — 792:778) (10 specimens, WAM 150.76).

Kalumburu Mission: Sta. WA-218, WA-220 (37 specimens, FMNH 199503, FMNH 199505, FMNH 199511, FMNH 200530, FMNH 200537, FMNH 200548, WAM 541.80, WAM 542.80).

Pentecost River: El Questro Homestead — Sta. WA-592 (1 specimen, FMNH 204747).

Pillara Range: Pillara Spring — Sta. WA-250 (4 specimens, FMNH 200592).

The Pinnacles: 0.5 km west of Pinnacles Creek — Sta. WA-249, WA-589 (3 specimens, FMNH 199470, FMNH 204732).

Emanuel Range: Cave Spring, Bugle Gap (17 specimens, WAM 20.81, WAM 21.81, G. W. Kendrick, 28 June 1966, 9 august 1967).

Lawford Ranges: Nardji Cave — Sta. WA-363 (3 specimens, FMNH 199151); Mimbi Creek — Sta. WA-364 (1 specimen, FMNH 199154); Jones Spring — Sta. WA-365 (1 specimen, FMNH 199157).

Kununurra area: banks of Ord River diversion dam (1 specimen, WAM 30.81, S. Slack-Smith, 16 October 1976); Cave Springs Range — Sta. WA-240 (5 specimens, FMNH 200583); Jeremiah Hills — Sta. WA-673 (25 specimens, FMNH 205113, WAM 547.80); 13.7 km south of Limestone Mill — Sta. WA-601 (50 specimens, FMNH 204781, FMNH 204782, FMNH 204788, WAM 546.80); Weaber Ranges — near Point Spring - Sta. WA-238, WA-239 (67 specimens, FMNH 199541, FMNH 199611, FMNH 200579, FMNH 200580, WAM 545.80).

Ningbing Ranges, north of Kununurra, November 1966, May and June 1980, geographic sequence north to south: North of No. 8 Bore — Sta. WA-634, WA-700 (11 specimens, FMNH 204894, FMNH 204897, FMNH 205259, FMNH 205260); Utting Gap — Sta. WA-230, WA-639, WA-662 (4 specimens, FMNH 199958, FMNH 204927, FMNH 205054); 2.3 km south of Utting Gap — Sta. WA-643 (1 specimen, FMNH 204951); vicinity of Tanmurra Bore — Sta. WA-628, WA-654, WA-658 (11 specimens, FMNH 204870, FMNH 204871, FMNH 205017, FMNH 205033, WAM 540.80); The Gorge, Central Ningbing Ranges — Sta. WA-646, WA-647 (10 specimens, FMNH 204966, FMNH 204972, FMNH 204973); 1.7-4.3 km south of Ningbing Bore — Sta. WA-226, WA-602, WA-604, WA-605, WA-607, WA-608 (23 specimens, FMNH 200343, FMNH 204801, FMNH 204802, FMNH 204811, FMNH 204818, FMNH 204821, WAM 539.80); near 4 Mile Creek — Sta. WA-614, WA-617, WA-619 (4 specimens, FMNH 204835, FMNH 204840, FMNH 204846).

NORTHERN TERRITORY Sorby Hills: Sta. WA-677 (3 specimens, FMNH 205134).

Keep River, north-east of Wyndham, near NT-WA border (1 specimen, Australian Museum, K. Sutherland, June 1964).

Victoria Highway: 24.4 km east of Timber Creek Police Station, 44.1 km west of Fitzroy Station turnoff, limestone ridges — Sta. WA-680 (8 specimens, FMNH 205151, A. Solem, L. Price, F. & J. Aslin, June 1980).

Discussion: The above records accurately reflect areas of land snail collection in Western Australia and the fringes of the Northern Territory. A number of collections have been made on the south of Lake Argyle and towards Halls Creek, without any specimens of *Westracystis* being obtained. The many hills between Fitzroy Crossing and The Pinnacles have yielded comparatively few positive stations, and even in the Napier Ranges east of Yammera Gap, examples have been collected only at noticably wetter sites that retain moisture longer. A number of Oscar Range localities yielded camaenids, but no *Westracystis*. It is not possible to draw a meaningful boundary or to identify the exact reasons for sporadic occurrences in the south-east Kimberley. Some of the localities may have yielded subfossil material leached from soil and thus not accurately reflect extant pupulations. As a tentative hypothesis, however, I would estimate that the south-east range would closely approximate the normal 500 mm rainfall line, adjusted to a minor extent to include a few sheltered spots that retain moisture effectively, and exclude a few open sites to the north of this line where evaporation is more rapid than normal.

An interesting study would be to follow shell growth patterns in the south-east fringe areas compared with the patterns in the wetter coastal areas.

The illustrated genital system is based on material collected 14 November 1976 from near Point Spring, Weaber Ranges, north of Kununurra. The specimen was the large morph. Additional material was dissected from the Ningbing Ranges (Sta. WA-700, FMNH 205260), Napier Range (Sta. WA-194, FMNH 200309), King Leopold Ranges (Sta. WA-316, FMNH 200513), and Mitchell Plateau (Sta. WA-203, FMNH 200382, FMNH 200090). The latter included specimens of both morphs, the Napier material was of the small morph only. No significant differences were observed, and I am convinced that only one species can be recognized. Except the Ningbing specimen taken in June 1980, all the remaining material was from October and November 1976. Thus no information on possible seasonal variation in the genital system can be offered, as all material studied was in dry season mode.

Westracystis tentus Iredale, 1939 was based on specimens of the small morph from the Napier Range and is thus synonymized with W. lissus (Smith, 1894). Actually, the types of *tentus* are from one of the type lots of *lissus*, since Froggatt collected the "Burner" Range (= Napier Range) material sent by Cox to E. A. Smith for identification. Smith (1894) correctly considered both morphs to be one species, while Iredale (1939) separated them.

I have not selected lectotypes, as the illustrated specimen of *W. tentus* was not located in the Australian Museum and would have preference as type, and the British Museum (Natural History) material was examined several years ago and compared with Mitchell Plateau and Napier material, but type designation not attempted.

Few SEM radular photographs of helicarionids have been published, and only the reports of Kershaw (1979, 1981) are of closely related taxa. In both *Helicarion cuvieri* Ferussac, 1819 (Kershaw, 1979: 148, figs. 2-3) and *H. niger* (Quoy and Gaimard, 1832) (Kershaw, 1981: 25-26, figs. 2-3) the ectocone on the lateral teeth and the anterior flare of the lateral teeth are strikingly larger than those of *Westracystis* (figs. 1, 4, 6, 7, 11). In the *Helicarion*, the transition between lateral and marginal teeth (Kershaw, 1979: fig. 3; Kershaw, 1981: fig. 2 as printed) occurs over three or four teeth, while in *Westracystis* (figs. 1, 2, 3, 7, 9) the shift takes place in two teeth. Data on the total number of teeth per row in *Helicarion* is not available.

Westracystis fredaslini, n. sp.
Figs. 6, 7-11, 15, 17, 19

Diagnosis: A species of *Westracystis* with shortened epiphallus (E), epiphallic flagellum (EF), and retractor caecum (ERC, fig. 17b), maximum diameter of shell 9.5-11 mm, upper palatal lip rarely slightly sinuated (fig. 15b), umbilicus internally with a few weak incised spiral lines, columellar lip slightly reflecting over umbilicus (fig. 15c), thickened and twisted. *W. lissus* (E. A. Smith, 1894) from the Kimberley, Western Australia and as far east as the Victoria Highway, 24.4 km east of Timber Creek Police Station, in the Northern Territory is smaller, maximum shell diameter 7-9.5 mm, more tightly coiled, with the upper palatal lip more strongly sinuated, the umbilicus narrower because of lip reflection, and with much longer epiphallus, epiphallic flagellum, and retractor caecum (fig. 16a).

Holotype: WAM 519.80, Station WA-688, near mouth of Cutta Cutta Cave, 16 Mile Cave Reserve, south of Katherine, Northern Territory. "Manbulloo" 1:100,000 map sheet 5368 — 272:865. Collected by A. Solem, L. Price, F. & J. Aslin 4 June 1980. Height of holotype 5.6 mm, diameter 9.95 mm, H/D ratio 0.563, whorls 4 5/8-, umbilicus very narrow.

Paratopotypes: WAM 521.80, WAM 522.80, FMNH 205209, FMNH 205210, 4 live and 30 dead specimens from the type locality.

Paratypes: Northern Territory: Sta. WA-697, south bank of Roper River just below Falls, ca. 18 km east of Mataranka (Mataranka 5568 — 150:470) (2 live, 23 dead specimens, WAM 523.80, FMNH 205250, FMNH 205251); Elsie Station, Roper River, ca. 200 m below Elsie Falls (4 specimens, Australian Museum, collected by V. Kessner 10 June 1978); Sta. WA-682, scattered limestone 11.15 km north-west of Katherine River (Katherine 5369 — 961:057) (1 dead specimen, FMNH 205169); Sta. WA-685, limestone outcrops 3.0 km north-west of Katherine River bridge (Katherine 5369 — 021:015) (1 live, 178 dead specimens, WAM 525.80, FMNH 205184, FMNH 205191); Sta. WA-686, limestone knoll near Lower Reserve, Katherine (Katherine 5369 — 013:983) (28 dead specimens, WAM 524.80, FMNH 205197). All WA station collections between 4 June and 11 June 1980.

Description: Shell relatively large, diameter 9.5 to 11 mm, whorls 4½ to 5. Coiling pattern looser than in *W. lissus*, palatal lip rarely sinuated above. Shell surface microscopically smooth except for radially incised growth pauses or repaired breaks to shell, appearing burnished at high magnification. Umbilicus narrow, slightly covered by reflection of columellar lip, internally with a few weak incised spiral lines, lip edge thickened. Radular teeth (figs. 6-11) with tricuspid central (fig. 6); usually 11 laterals (fig. 7) with very small endocone and prominent interrow support system; transition to marginals occurring in two teeth (fig. 9), with loss of anterior flare, gross narrowing of tooth, loss of endocone, size increase of ectocone, and greater elevation of cusp shaft; marginals (figs. 8-10) 22-25, bicuspid, only slight anterior flare, mesocone narrowing and reduced in prominence. Genitalia (figs. 17b, 19) with apical genitalia as in *W. lissus* (figs. 16b, c). Terminal female organs as in *W. lissus*. Vas deferens (VD) joining epiphallus parallel to insertion of epiphallic flagellum (EF), below apex of penial sheath. Epiphallus (E) short, attachment of penial retractor muscle (PR) near to head of penial sheath. Epiphallic flagellum (EF) and retractor caecum (ERC, fig. 17b) shorter than in *W. lissus* (fig. 16a). Penis

(P, fig. 19) partly double walled, internally with vague ridges basally, epiphallus (E) with narrow ridges approaching a corrugated pattern. Penis sheath (PS) thin walled, without upper collar attachment, extending down to atrium (Y). Mantle collar with two slender laps (L), presumably respiratory in function (fig. 17a), contractile in part, capable of reaching over more than half shell diameter. Tail with prominent caudal horn (CH), gonopore (YO) located behind and slightly below right rhinophore (TV), well behind and below right ocular tentacle (TE). Pedal grooves relatively faint, not shown in diagram (fig. 17a).

Discussion: Great plasure is taken in dedicating this species to Fred Aslin of Mt. Gambier, South Australia, dedicated student of small Australian land snails, and generous helper to so many scientists in so many fields over the past decades. His help during trips to the Kimberley, Nullabor, Flinders Ranges and Red Centre in search of land snails has been invaluable to my work and hence this token recognition.

All known localities of *W. fredaslini* are from the scattered exposures of Middle Cambrian Tindall Limestone of the Daly River Group found from about 12 km north of Katherine south to the Roper River. The occasional island exposures of this generally underlying formation harbour a significant local radiation of camaenid land snails (Solem, unpublished) and the endemic *Gyliotrachela catherina* Solem (1981c: 91-92). The moisture retaining qualities of the limestone and multiplicity of shelter sites that is provided by limestone talus enable long term survival, whereas the drier moisture regime and paucity of shelter sites in the commonly exposed rocks of this area are unsuitable habitats for land snails unless special situations provide moisture retaining conditions. Generally the Tindall limestone is exposed as pillars or low ridges in depressions, which improves the moisture retention potential of the habitats.

Both radulae of *W. fredaslini* showed the greater number of lateral teeth and smaller number of marginal teeth than *W. lissus*, as mentioned above. Late rains in the Katherine area had occured shortly before our collecting. The great wear encountered by this species when feeding is illustrated in fig. 11, showing anterior, eroded central and lateral teeth. The wear does give a good indication of the interrow support system as the mesocone cusp is no longer obscuring the tooth base.

All specimens of *W. fredaslini* were collected early in the dry season, whereas most of the dissected *W. lissus* were late dry season examples. No differences were detected that could be ascribed to seasonal changes in the genitalia.

DISCUSSION

The two species of *Westracystis* are readily distinguished on the basis of genital anatomy, although the shell differences — size and contours — are more subtle and overlap to some extent. At present the absence of any significant collecting effort between the Western Australia-Northern Territory border and Darwin prevent estimating the eastern range limit of *Westracystis lissus* (E. A. Smith, 1894), and the total lack of collecting east of Darwin and north of Katherine, make statements about actual ranges for *W. fredaslini* or possible eastern relatives subject to future resolution.

Since both species will be locally abundant (figs. 12, 13), they would be quite suitable for life history investigations. The hypothesized two year growth cycle for *N. lissus* needs to be investigated and then compared with the four year cycle demonstrated for Kimberley camaenids (Solem, 1981a).

LITERATURE CITED

Baker, H. B. 1941. Zonitid snails from Pacific Islands. Parts 3 and 4. *Bernice P. Bishop Mus., Bull.*, 166: 205-370.

Hedley, C. 1916. A preliminary index of the Mollusca of Western Australia. *J. Roy. Soc. Western Australia*, 1: 1-77.

Iredale, T. 1933. Systematic notes on Australian land shells. *Rec. Australian Mus.*, 19 (1): 37-59.

———— 1937. A basic list of the land Mollusca of Australia. — Part II. *Australian Zool.*, 9 (1): 1-39.

_____ 1939. A review of the land Mollusca of Western Australia. *J. Roy. Soc. Western Australia*, 25: 1-88.

Kershaw, R. C. 1979. Redescription of *Helicarion cuvieri* from Southern Tasmania and *Helicarion freycineti* from New South Wales (Pulmonata: Helicarionidae). *J. Malac. Soc. Australia*, 4 (3): 145-156.

_____ 1981. Redescription of the genus *Helicarion* and of *Helicarion niger* (Quoy and Gaimard, 1832) from Victoria (Pulmonata: Helicarionidae). *J. Malac. Soc. Australia*, 5 (1-2): 17-32.

Merrifield, H. E., S. M. Slack-Smith, and B. R. Wilson. 1977. Report on the mollusc fauna of the Drysdale River National Park, North Kimberley, Western Australia. *Wild. Res. Bull. Western Australia* no. 6: 110-120.

Odhner, N. H. 1917. Mollusca. XVII. Results of Dr. E. Mjöbergs Swedish Scientific Expeditions to Australia 1910-1913. *Kungl. Svenska Vetenskap. Handl.*, 52 (16): 1-115.

Smith, E. A. 1894. On the land-shells of Western Australia. *Proc. Malac. Soc. London*, 1 (3): 84-99.

Solem, A. 1966. Some non-marine mollusks from Thailand, with notes on the classification of the Helicarionidae. *Spolia Zool. Mus. hauniensis*, 24: 1-110.

_____ 1979. Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae), I. Taxa with trans-Australian distributions. *Rec. Western Australia Mus.*, Suppl. no. 10: 1-142.

_____ 1981a. Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae), II. Taxa from the Kimberley, *Amplirhagada* Iredale, 1933. *Rec. Western Australia Mus.*, Suppl. no. 11: 143-320.

_____ 1981b. Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae), III. Taxa from the Ningbing Ranges and nearby areas. *Rec. Western Australian Mus.*, Suppl. no. 11: 321-425.

_____ 1981c. Small land snails from Northern Australia, I: Species of *Gyliotrachela* Tomlin, 1930 (Mollusca: Pulmonata: Vertiginidae). *J. Malac. Soc. Australia*, 5 (1-2): 87-100.

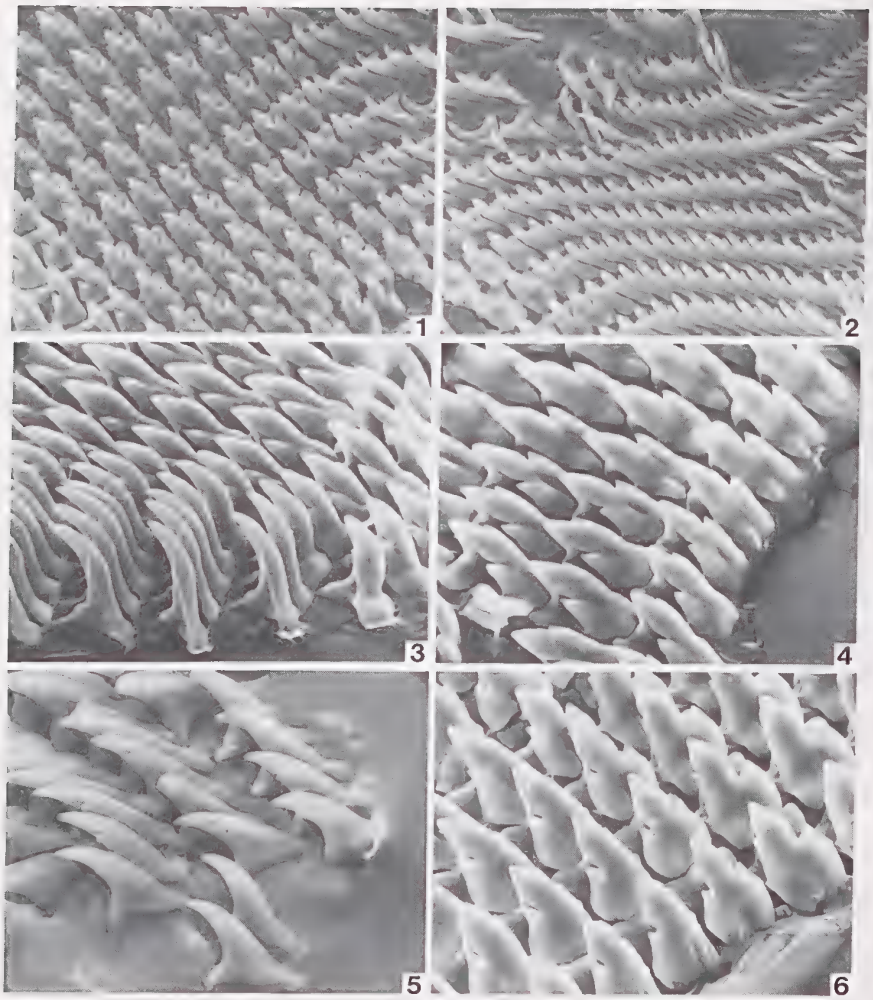
_____ In preparation. Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae), IV. Taxa from the Kimberley, *Westraltrachia* Iredale, 1933 and related genera.

Wilson, B. R. and P. Smith. 1975. A report on the mollusc fauna of the Prince Regent River Reserve, North-West Kimberley. *Wild. Res. Bull. Western Australia* no. 3: 97-100.

APPENDIX

List of anatomical abbreviations

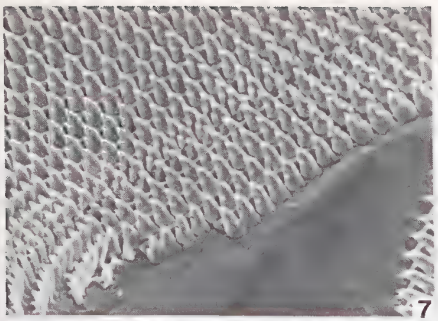
CH, caudal horn; DG prostate; E, epiphallus; EF, epiphallic flagellum; ERC, epiphallic retractor caecum; G, ovotestis; GD, hermaphroditic duct; GG, albumen gland; GT, talon; L, shell lap; P, penis; PR, penial retractor muscle; PS, penis sheath; S, sepermatheca; TE, ocular tentacle; TV, rhinophore; UT, uterus; UV, free oviduct; V, vagina; VD, vas deferens; X, carrefour; Y, atrium; YO, gonopore.

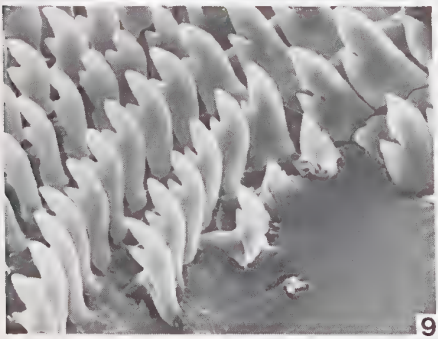


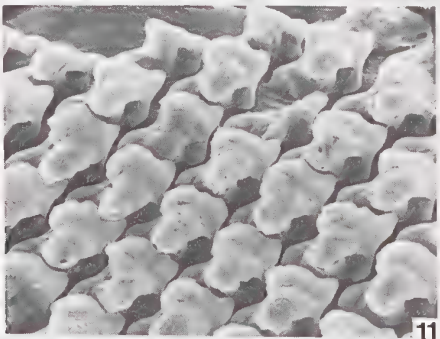
FIGURES 1-6: Radular structures

1-5 *Westracystis lissus* (Smith, 1894): 1, 2, 5 Sta. WA-238, Point Spring, Weaber Ranges, north of Kununurra, Western Australia, FMNH 200579, 1 — central and lateral teeth at X413, 2 — marginal teeth at X406, 5 — low angle view of outermost marginal teeth at X772; 3-4 Sta. WA-316, Mt. Hart Homestead, King Leopold Range, north-east of Derby, FMNH 200513, 3 — low angle view of latero-marginal transition at X687, 4 — tricuspid central and asymmetrically tricuspid laterals at X675.

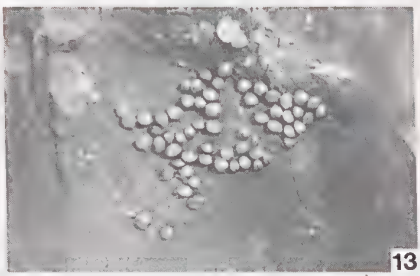
6 *Westracystis fredaslini,* n. sp.: Sta. WA-688, mouth of Cutta Cutta Cave, south of Katherine, Northern Territory, FMNH 205210, central and early lateral teeth at X730.







FIGURES 7-11: Radular structures of *Westracystis fredaslini*, n. sp.: Sta. WA-688, mouth of Cutta Cutta Cave, south of Katherine, Northern Territory, FMNH 205210, paratopotype: 7 — central and lateral teeth at X200, 8 — marginal teeth at X347, 9 — latero-marginal transition at X713, 10 — low angle view of marginal teeth at X1, 373, 11 — worn anterior central and lateral teeth at X661.



FIGURES 12-13: Clusters of living *Westracystis lissus* (Smith, 1894) in aestivation: 12 — Sta. WA-202, Mitchell Plateau, FMNH 200377, 13 — Sta. WA-203, Mitchell Plateau, FMNH 200090. Both collected in late October 1976.

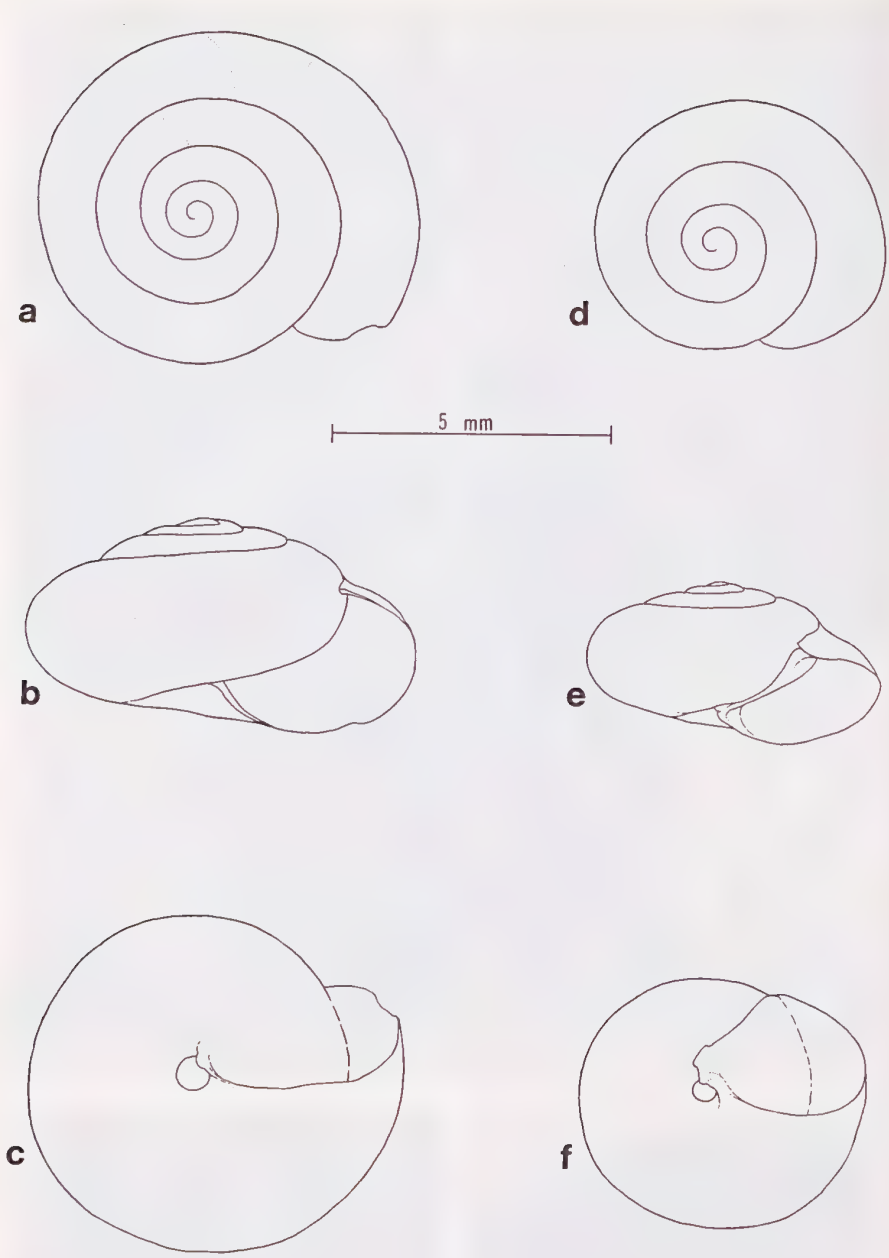


FIGURE 14: Shells of *Westracystis lissus* (Smith, 1894): a-c, Sta. WA-238, slope northwest of Point Spring, Weaber Ranges, north of Kununurra, Western Australia. FMNH 200580. Collected 14 November 1976; d-f, Sta. WA-221, "drop-off" camp area, Port Warrender Road, Mitchell Plateau, Western Australia. WAM 520.80. Collected 30 October 1976. Scale line equals 5 mm. Drawings by Elizabeth A. Liebman.

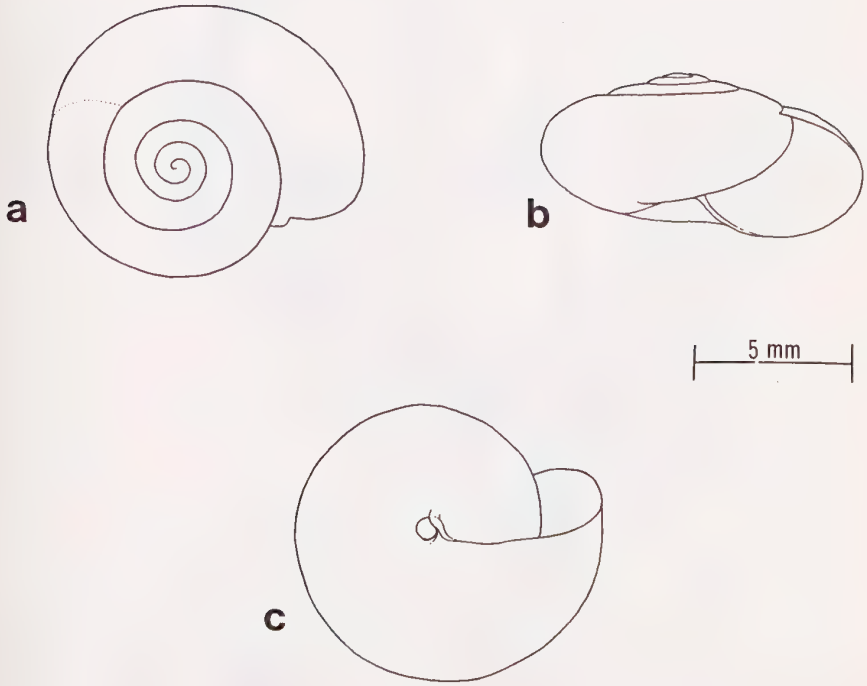


FIGURE 15: Shell of *Westracystis fredaslini* n. sp. Sta. WA-688, near mouth of Cutta Cutta Cave, 16 Mile Cave Reserve, south of Katherine, Northern Territory. WAM 519.80. 4 June 1980. Holotype. Scale line equals 5 mm. Drawings by Elizabeth A. Liebman.

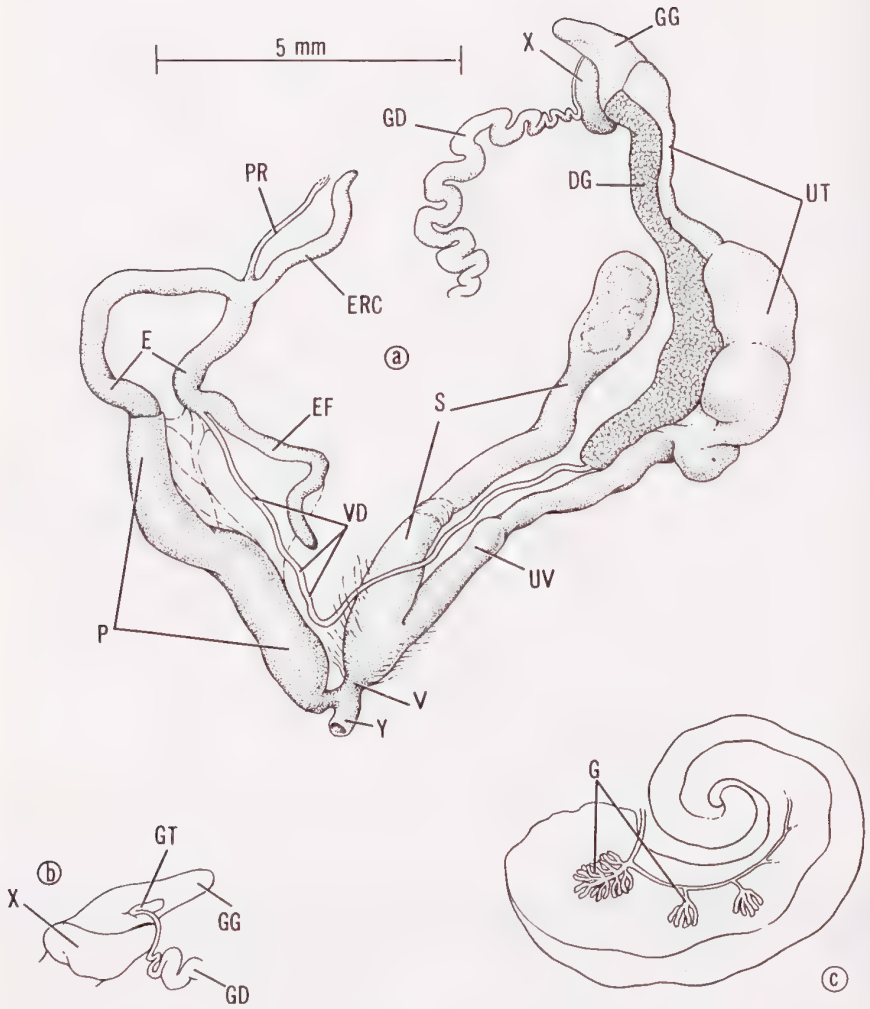


FIGURE 16: *Westracystis lissus* (Smith, 1894). Sta. WA-238, slope north-west of Point Spring, Weaber Ranges, north of Kununurra, Western Australia. FMNH 200579. 14 November 1979: a, genitalia; b, detail of talon-carrefour region; c, ovotestis. Scale line for a equals 5 mm. Drawings by Elizabeth A. Liebman.

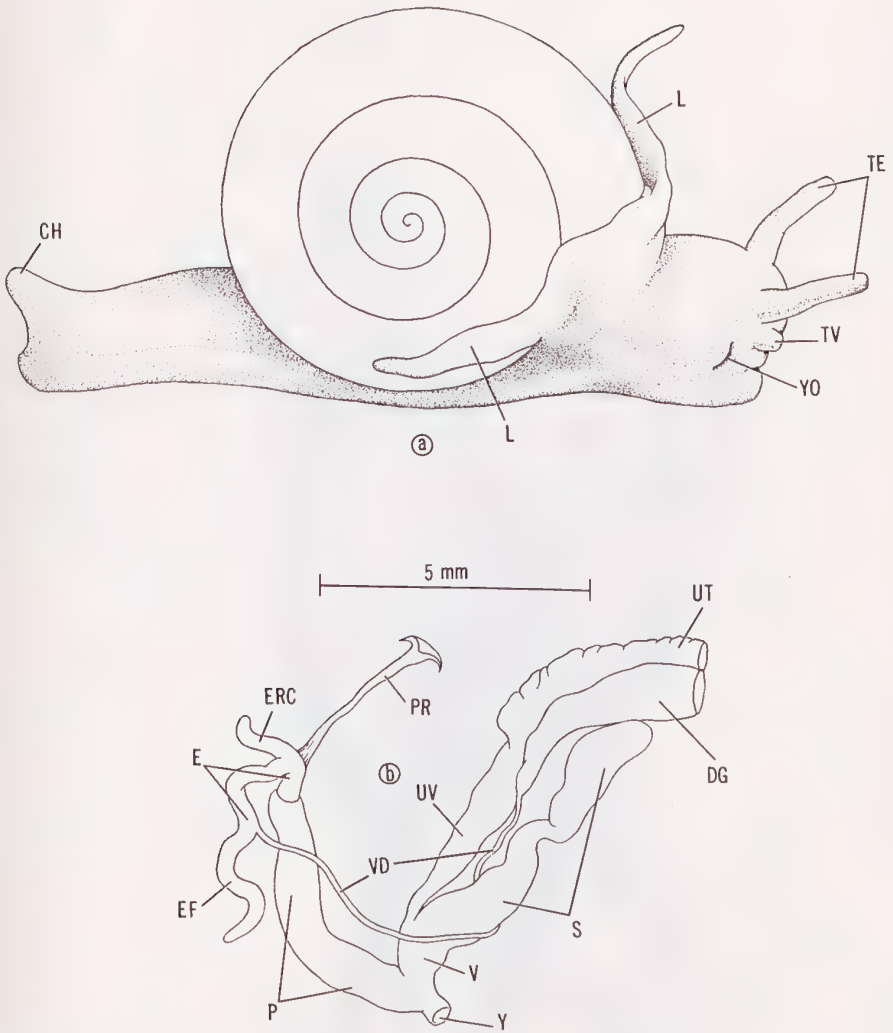


FIGURE 17: *Westracystis fredaslini* n. sp. Sta. WA-688, near mouth of Cutta Cutta Cave, 16 Mile Cave Reserve, south of Katherine, Northern Territory. FMNH 205210. 4 June 1980: a, exterior of preserved animal; b, terminal genitalia. Scale line equals 5 mm. Drawings by Elizabeth A. Liebman.

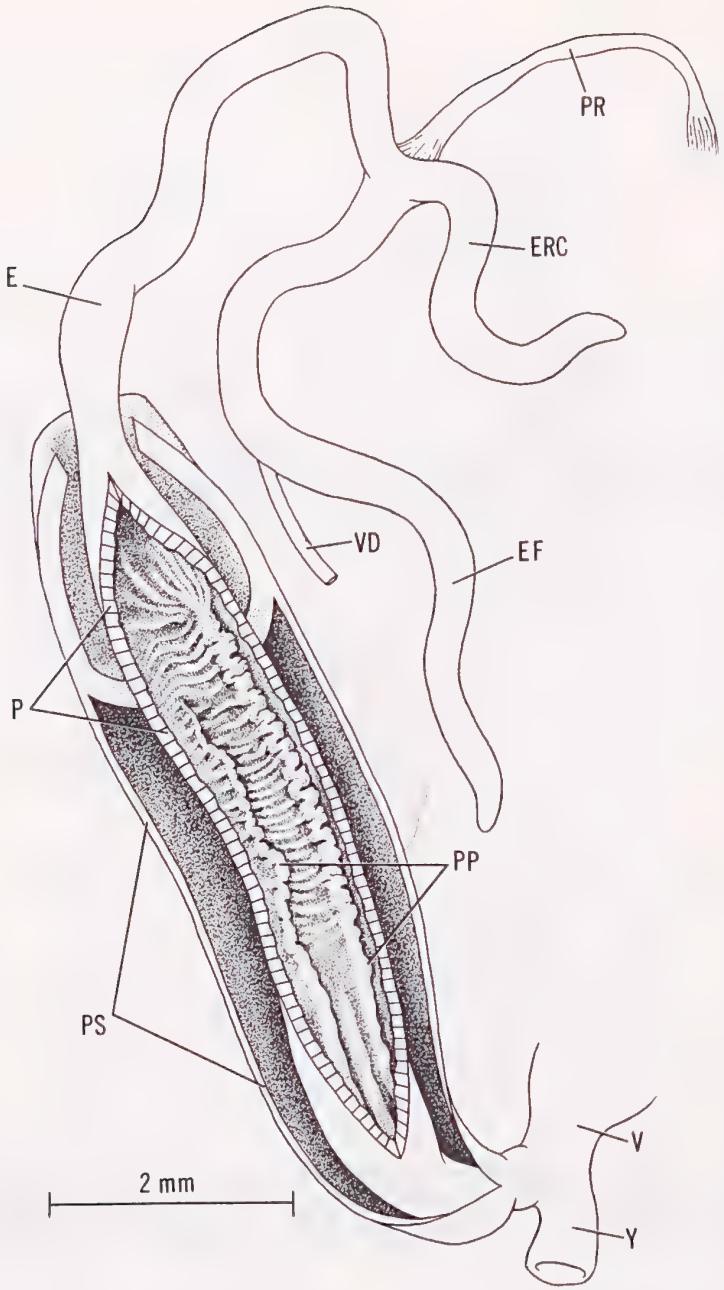


FIGURE 18: *Westracystis lissus* (Smith, 1894). Sta. WA-238, slope north-west of Point Spring, Weaber Ranges, north of Kununurra, Western Australia. FMNH 200579. 14 November 1976: interior of penis complex. Scale line equals 2 mm. Drawing by Elizabeth A. Liebman.

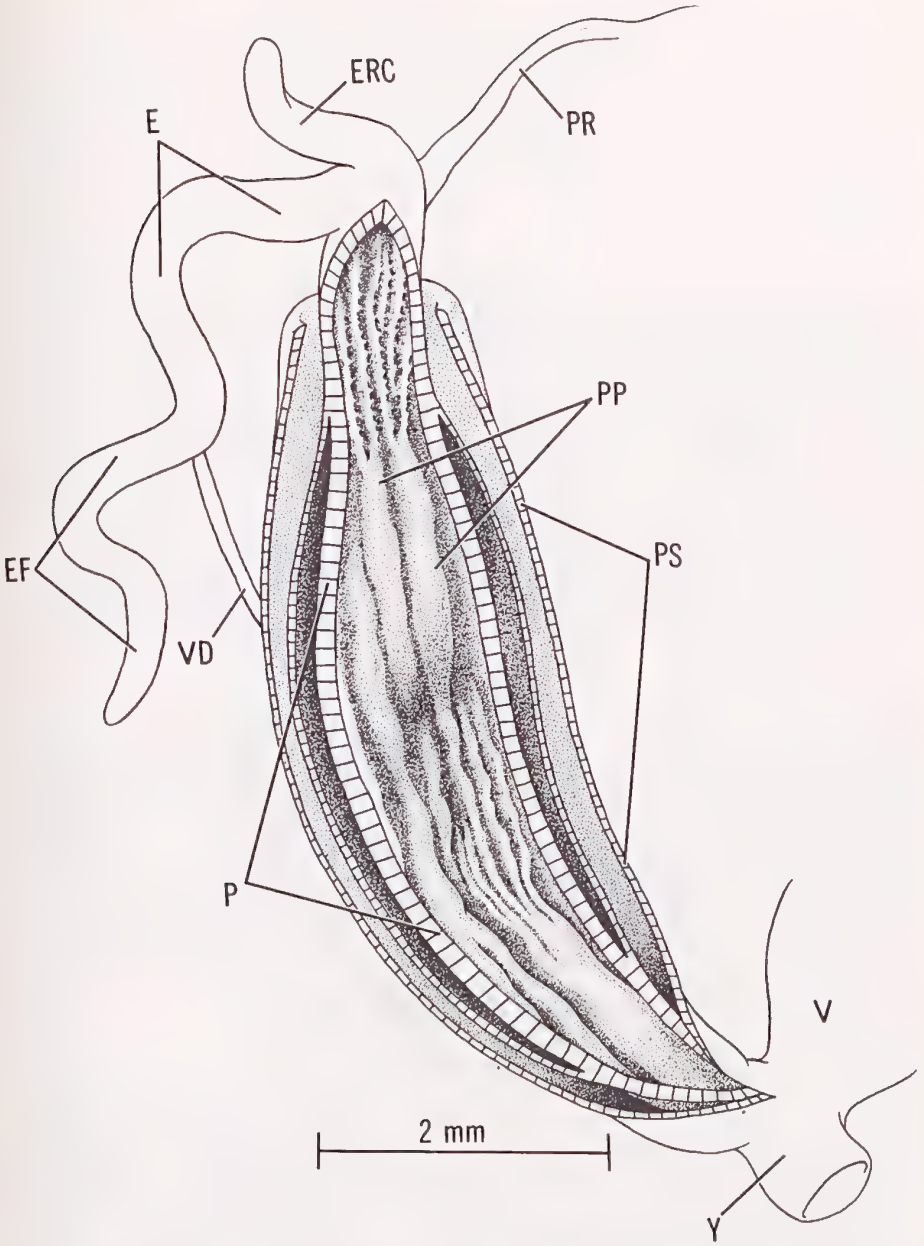


FIGURE 19: *Westracystis fredaslini* n. sp. Sta. WA-688, near mouth of Cutta Cutta Cave, 16 Mile Cave Reserve, south of Katherine, Northern Territory. FMNH 205210. 4 June 1980: interior of penis complex. Scale line equals 2 mm. Drawing by Elizabeth A. Liebman.